REMARKS

This is in response to the Office Action of April 6, 2007. New claims 12 and 13 are added, based upon such disclosure as that in the last full paragraph on page 43 of the specification ("The turbidity of the resulting photoresist resin is generally from about 0 to about 10, preferably from about 0 to about 3 .... The turbidity herein is determined ... according to Japanese Industrial Standard (JIS) K 0101"). No new matter is introduced by this Amendment. Claims 6-13 are pending in the application.

The claimed invention

Claim 6, the sole independent claim herein, requires: A photoresist resin comprising at least a constitutional repeating unit A containing a group capable of partially leaving by the action of an acid to thereby become soluble in an alkali; and a constitutional repeating unit B containing an alicyclic skeleton having a polar group, wherein the resin (i) has a weight-average molecular weight of 3000 to 15,000 and (ii) has a molecular weight distribution (Mw/Mn, wherein Mw is weight-average molecular weight and Mn is number-average molecular weight) of from 1.1 to 3.5 and (iii) has a content of polymer fractions each having a molecular weight exceeding 40,000 of 4 percent by weight or less of the total resin.

Prior art rejection

Claims 6-11 stand rejected under 35 U.S.C. § 102(b) as being anticipated by US 2002/0102491 A1 to Kodama et al. ("Kodama"). The rejection is respectfully traversed.

CLAIMS 6-13 – FEATURE (iii)

The Kodama reference fails to teach or suggest at least feature (iii) of the presently claimed invention. That is, Kodama fails to teach or suggest a resin which has content of polymer fractions each having a molecular weight exceeding 40,000 of 4 percent by weight or less of the total resin. This feature of the presently claimed photoresist resins provides the presently claimed photoresist resins with unexpected, beneficial properties, as discussed in detail below.

A resin having a narrow molecular weight distribution and a low weight-average molecular weight is different from a resin that has content of polymer fractions each having a molecular weight exceeding 40,000 of 4 percent by weight or less of the total resin. In fact, some resins have a molecular weight exceeding 40,000 of 4 percent by weight or more of the total resin, even when their molecular weight distribution is narrow or their overall molecular weight is low. Likewise, some resins have a molecular weight exceeding 40,000 of 4 percent by weight or less of the total resin, even when their molecular weight distribution is broad or their overall molecular weight is high.

There is no basis for the holding that feature (iii) is inherently disclosed in Kodama. As discussed in Applicants' specification, a resin having a content of polymer fractions each having a molecular weight exceeding 40,000 of 4% by weight or less of the total resin is obtained by specially designed synthetic processing, such as adding monomer solution and polymerization initiator solution dropwise separately from different vessels to a reactor, or by controlling polymerization temperature (the temperature of the reaction mixture) in a dropwise polymerization so as to minimize the variation or deviation of the polymerization temperatures. Specification, page 18, lines 25 to page 21, line 20.

With regard to dropwise polymerization, Kodama describes a process in which a mixture of monomers and a polymerization initiator V-65 dissolved in a solvent was added dropwise over a period of 4 hours to a solvent heated to 60°C, further V-65 was added, and the reaction was run for an additional 2 hours. Kodama, paragraph [0459]. When the temperature in the reactor is controlled at a target pre-set temperature at the beginning of the dropwise addition described by Kodama, the system temperature tends to fall below the pre-set temperature, and so the control system in Kodama heats the reaction mixture.

As discussed in Applicants' specification, when the polymerization is carried out under such conditions that the polymerization temperature deviates plus or minus 5°C from the pre-set temperature (that is, the variation of the polymerization exceeds ±5°C) during 7 percent or more of the total time period during which dropwise addition is conducted (e.g., 30 minutes or more), this results in a higher than 4% content of polymer fractions each having a molecular weight exceeding 40,000. Specification, page 19, line 13 to page 21, line 20. Thus, the processing improvement which ***enables*** the presently claimed novel resins is quite sensitive with respect to its specific parameters.

Moreover, when the content of polymer fractions each having a molecular weight exceeding 40,000 exceeds 4% by weight – even if the resin satisfies conditions (i) and (ii) recited in Applicants' claims – the resin contains insoluble matter (turbidity) when dissolved in a resist solvent. This insoluble matter requires much time and effort to remove by filtration, which results in an inefficient production of the photoresist resin composition. Specification, page 17, line 19 to page 18, line 6.

CLAIMS 12 AND 13 – SPECIFIC TURBIDITY VALUES

"Turbidity," or the presence of insoluble matter in a solution, is a separate consideration from "solubility," which relates to the amount of substrate dissolving into the solvent. If a resin is characterized by producing turbidity, problems inimical to the optimum employment of the photoresist composition occur due to the insoluble matter which causes the turbidity. The turbidity index, therefore is an important index in the art to which the present invention pertains.

Turbidity is a characteristic of resins ***not*** of the present invention, which are produced, for instance, by polymerization carried out under such conditions that the polymerization temperature deviates ±5°C from the pre-set temperature, as discussed above. In contrast, the resins of Applicants' claims have a molecular weight exceeding 40,000 of 4% by weight or less of the total resin. Accordingly, Applicants' resins dissolve easily in resist solvents, and provide solutions that are free from turbidity. Thus Applicants' invention permits the omission or simplification of a filtration step, thus providing for a significantly improved manufacturing process.

In the present application, the turbidity is determined by mixing 1 gram of a sample photoresist resin with 19 grams of polypropylene glycol monomethyl ether acetate, shaking the resulting mixture at room temperature for 60 minutes to yield a resin mixture having a resin concentration of 5% by weight, and measuring the turbidity of the resin mixture in accordance with Japanese Industrial Standard (JIS) K 0101 (integrating-sphere turbidity). Specification, page 43, lines 16 to 23. As summarized in lines 8-12 on page 54 of the specification, resins according to Applicants' Examples 1 and 2 each had a turbidity of 0.0, while the resin according to Comparative Example 1 had a turbidity of 13.3. It should be

noted that the resin of Comparative Example 1 had a content of polymer fractions each having a molecular weight exceeding 40,000 of 4.7% by weight.

SUMMARY

Due to the feature "the resin ... has a content of polymer fractions each having a molecular weight exceeding 40000 of 4 percent by weight or less of the total resin" in the present claims, the resin of the present invention can be easily dissolved in resist solvents (see claims 6-13). This provides the benefit that a filtration step can be omitted or simplified during the manufacturing process, resulting in an unexpectedly more economical manufacturing process. Nothing in the Kodama reference teaches nor suggests this feature or this benefit. Accordingly, withdrawal of the rejection of record is in order and is earnestly solicited.

Conclusion

If there are any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Richard Gallagher (Reg. No. 28,781) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

The Examiner is again respectfully requested to initial the Form PTO-1449 that was filed herein on January 5, 2005.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

RC By _____

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